CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
SAN FRANCISCO BAY REGION

ORDER NO. 91-101

SITE CLEANUP REQUIREMENTS AND RECISION OF ORDER NO. 89-080 FOR:

ADVANCED MICRO DEVICES
915 DEGUIGNE DRIVE
SUNNYVALE
SANTA CLARA COUNTY

The California Regional Water Quality Control Board, San Francisco Bay Region (hereinafter called the Board) finds that:

1. Location and Facility Description - Advanced Micro Devices (AMD) owns and operates a semiconductor manufacturing facility at 915 DeGuigne Drive, Sunnyvale, Santa Clara County (AMD 915). The AMD 915 site is in a broad area bounded by the Bayshore, Central, and Lawrence Expressways and Fair Oaks Drive (see Appendix 1, Figure 1). The facility is located in an industrial park setting bordered by residential areas.

   This is an area of northern Santa Clara County with topography that is flat; local surface water drainage is to the north toward San Francisco Bay. Vegetation in the area is grass, and landscaped shrubs and trees, with much of the surface area given over to paved parking areas.

2. Site History - Advanced Micro Devices Building 915 (AMD 915) was built in 1974, and was the first commercial construction at this site. This facility was designed and has been used as a semiconductor fabrication facility from 1974 through the present. The manufacturing processes at this site have involved the use of solvents, caustics, and acids. No metal plating has occurred at the AMD 915 facility.

   Initial investigation at this site began voluntarily in 1982. As many as 28 separate underground tanks may have been in service at various times at the AMD 915 site. The majority of these tanks have been removed from service or replaced with doubly contained above or below ground units.

   During tank removals two leaking underground tanks have been identified. The first of these was the removal of two 1500 hundred gallon tanks, one for photoresist solution and the other for waste solvent, from the Pad IV area. The photoresist tank was documented to have leaked when both tanks were removed in 1981.

   The second leaking underground tank was one tank in a three tank underground acid neutralization system (ANS). The leak in this tank

from the ANS, located at pad "C", was documented when a hole was noted in one tank during removal in late 1981.
These two areas have been identified as potential point source of contamination. Based on soil sampling in the excavation and groundwater monitoring data the "C" ANS is probably the dominant source of groundwater contamination at the AMD 915 site.

Groundwater investigation also began in 1982 as part of the investigation of the leaking underground tanks previously documented. Ongoing extraction of groundwater through existing building dewatering sumps was supplemented in 1982 with the addition of the first in a series of groundwater extraction wells. Monitoring of groundwater quality has been ongoing, at least quarterly, since 1982.

Pursuant to the South Bay Multi-Site Cooperative Agreement (MSCA) and the South Bay Ground Water Contamination Enforcement Agreement, entered into on May 2, 1985 (as subsequently amended) by the Regional Board, EPA and DHS, the Regional Board has been acting as the lead regulatory agency. The Regional Board will continue to regulate the discharger's remediation and administer enforcement actions in accordance with CERCLA as amended by SARA.

The site has been included on the National Priorities List (NPL) and has been regulated by Regional Board Orders, as indicated herein:

a.	April 1985	Waste Discharge Requirements Adopted
b.	June 1988	AMD 915 Proposed for Inclusion on the NPL
c.	May 1989	Site Cleanup Requirements Adopted
d.	September 1990	AMD 915 added to the NPL
e.	December 1990	Reissuance of Waste Discharge Requirements Adopted

3. Regulatory Status AMD is hereinafter referred to as a discharger because of the releases of hazardous wastes that have occurred at its site. AMD is also a Responsible Party under Federal Superfund regulations (CERCLA/SARA), and was included on the National Priorities List (NPL) in September 1990.

This Order is intended to outline a proposed plan for the final remedial actions at the AMD 915 facility, as required by CERCLA/SARA. EPA is expected to agree with the selected remedy and issue a Record of Decision following adoption by the Board of a final Order approving the Remedial Investigation and Feasibility Study (RI/FS) and a final Remedial Action Plan (RAP).

4. Scope and Role of Operable Unit Within Site Strategy For purposes of these reports and the proposed final RAP, AMD 915 Deguigne Drive has been designated as a single Operable Unit (see Appendix 1, Figure 2).

   The purpose of the actions at AMD 915 is to control the migration of polluted groundwater from the site and to capture and remediate existing contaminated groundwater. The intent of these actions is to expedite cleanup of groundwater at this site and to prevent movement of contaminated groundwater from the onsite area to offsite and potential vertical migration into aquifers that currently serve as drinking water sources.

5. Remedial Investigation/Feasibility Study and Proposed Final Cleanup Plan The discharger submitted a Draft Final RI Report, February 1, 1991 and Draft Final FS Report January 15, 1991. With the inclusion of the addendum to the FS, submitted in April 1990, these reports satisfy the requirements of Regional Board Order No. 89-080, Site Cleanup Requirements, adopted by the Board May 17, 1989. The FS report includes a detailed screening of alternatives for soil and groundwater remedial actions, a baseline risk assessment. The adoption of this Order will approve the RI/FS and a final RAP that will encompass cleanup at the AMD 915 facility.

   The technical information contained in the RI/FS and the Proposed Plan Fact Sheet is consistent with the Health and Safety Code requirements for a final RAP and the National Contingency Plan requirements for a RI/FS. The RI/FS contains an evaluation of the interim remedial actions, an evaluation of final remedial alternatives, proposed remedial standards, and a recommended final remedial action plan.

6. Hydrogeology Stratigraphy in the area surrounding the AMD 915 site is characterized by interbedded and interfingering sands, silts and clays. These sediments were deposited in complex patterns by fluvial-alluvial systems draining the uplands to the south: sediments were deposited as the streams flowed north toward the Bay.

   The nomenclature applied to the water bearing units in the study area is representative of the hydrogeology within the Santa Clara Groundwater Basin. A number of shallow water bearing units are separated from deeper aquifers by a thick persistent aquitard. The shallow units may be subdivided into a variety of zones depending upon depth, lithology and lateral persistence. These zones are frequently labeled as A and B zones. The deeper aquifer is commonly referred to as the C aquifer and the clay layer separating the upper and lower water-bearing zones is commonly referred to as the B-C aquitard. The aquitard has been reported to be between 50 and 100 feet thick in Santa Clara Valley.

Groundwater from this basin provides up to 50% of the municipal drinking water for the 1.4 million residents of the Santa Clara Valley. In 1989, groundwater accounted for approximately 128,000 of the 315,000 acre feet of drinking water delivered to Santa Clara Valley Water District customers. This water is produced from the C aquifer.

Three local aquifers have been identified through the investigation at AMD 915. The shallowest of these aquifers has been designated the A aquifer and extends from 7 to 20 feet below the ground surface. The permeable portion of this unit is generally from three to five feet thick. The next shallowest unit has been designated as the B1 aquifer which is separated from the A aquifer by a relatively impermeable zone of silty clays. The B1 generally occurs from 20 to 35 feet below the ground surface and appears to be lenticular and discontinuous in nature with highly variable thickness. The next unit has been designated as the B2 aquifer and is separated from the B1 aquifer by 12 to 35 feet of silty clay and clayey silt. Depth to the B2 aquifer at AMD 915 is highly variable ranging from 38 to 65 feet. Permeable units in the B2 range from 2.9 to 12 feet in thickness with an average thickness of 5 feet.

The horizontal groundwater gradient in all identified aquifers, in static conditions, is to the north toward San Francisco Bay. Local reversal of gradient is observed in the vicinity of groundwater extraction systems. The vertical hydraulic gradient is generally upward from the deeper aquifers and this has been verified to be the case at the AMD 915 site.

7. State Board Resolution 88-63 On March 30, 1989, the Regional Board incorporated the State Board Policy of "Sources of Drinking Water" into the Basin Plan. The policy provides for a Municipal and Domestic Supply designation for all waters of the State with some exceptions. Groundwaters of the State are considered to be suitable or potentially suitable for municipal or domestic supply with the exception of: 1) the total dissolved solids in the groundwater exceed 3000 mg/L, and 2) the water source does not provide sufficient water to supply a single well capable of producing an average, sustained yield of 200 gallons per day. Based on data submitted by AMD, the Board finds that neither of these two exceptions apply to the A and B zones at AMD 915 site. Thus, the A and B zones are considered to be potential sources of drinking water.

8. Source Investigation Five potential source areas of soil and/or groundwater contamination were investigated at AMD 915. These include the Pad IV photoresist stripper tank removed in 1981, the Pad "C" ANS removed in 1981, solvent tanks at Pad VI removed in 1986, Pad III waste solvent tank removed in 1987, and the East End diesel tanks investigated in 1988.

Of the five areas investigated two have been identified as possible sources of soil and groundwater contamination at the AMD 915 facility. These include an acid neutralization system north of the AMD 915 building at Pad "C" and the Pad IV photoresist stripper tank also north of the AMD 915 building. No other signs of leaking tanks were identified in the removal of tanks from the other three areas. Soil samples confirm the absence of contaminated soil in the vicinity of the other tanks.

The tank removal at the Pad IV area apparently removed contaminated soil containing greater than 100 mg/Kg of trichloroethylene (TCE). However, documentation of the depth of excavation and lateral extent of soil contamination was unavailable. Additional data collection to investigate remaining potential source soil contamination was completed in July 1990 as part of the final RI study. The only EPA 8240 compounds identified during this investigation were 1,2,4-Trichlorobenzene (1,2,4-TCB) and 1,2,3-Trichlorobenzene (1,2,3-TCB) at concentrations less than 1 mg/Kg (1 ppm in soil).

Additional offsite sources of groundwater contamination may have a significant affect on the AMD 915 site. The most notable of these are Advanced Micro Devices 901/902 Thompson Drive facilities, Signetics 811 East Arques site, and the FEI Microwave facility at 825 Stewart Drive. These three facilities have documented point sources of groundwater contamination which has commingled in the subsurface and may be impinging upon AMD 915 groundwater. Control of this commingled groundwater contamination plume and cleanup activities are being addressed under other Board Orders.

9. Extent of Pollution Soil pollution was the most concentrated near the AMD 915 acid neutralization system, located just north of the AMD 915 facility. Soil with up to 280,000 ppb of TCE were detected below the western-most tank in the three-tank acid neutralization system. Concentrations as great as 330,000 ppb of TCB have been detected in soil borings.

Additional excavation and removal of tanks was carried out at the Pad 4 area also north of the AMD 915 building (see Appendix 1, Figure 3). Soil samples from this excavation were analyzed only for TCB, xylene, toluene, and benzene. The depth of the excavation and lateral extent of soil contamination was poorly documented, in addition to the absence of analysis for VOCs. Therefore this was identified as a data gap in early drafts of the RI/FS and additional sampling was completed in July 1990. The only analytes detected in the soil samples from the additional soil borings were 1,2,4-TCB and 1,2,3-TCB. These analytes were present at levels below 1 mg/Kg and are not considered to represent significant soil contamination.

The lateral extent of groundwater contamination is limited to the AMD 915 site. Vertically, VOC contamination has been confirmed down to the B2 aquifer at depths up to 68 feet. Contamination has not been detected in the B3 zone.

TCE is the most prevalent groundwater contaminant and has been utilized as a indicator chemical for the AMD 915 site. Highest, initial levels of TCE contamination were recorded in monitor wells 9-S in the A aquifer and 9-D in the B1 aquifer in 1892. The maximum concentration of TCE in well 9-S was 4800 µg/l in 1982. The maximum concentration of TCE in well 9-D was 6600 µg/l in 1982. These wells were abandoned in 1988. The last sampling event prior to abandonment for well 9-S was in October 1987 when well 9-S had 800 µg/l TCE. The last sampling event prior to abandonment for well 9-D was in June 1988 and well 9-D had 1100 µg/l TCE. The maximum concentration of TCE in July 1990 was in well 41-D at 990 µg/l. This well is near the upgradient property boundary and is not necessarily representative of groundwater contamination related to onsite point sources.

10. Baseline Public Health Evaluation A Baseline Public Health Evaluation (BPHE) is conducted at every Superfund site to evaluate the risk posed by the site in its existing condition. The BPHE examines the chemicals present at the site and the possible routes of exposure to humans and animals. Once the potential risk or hazard from the site is established, judgments can be made as to which environmental laws and standards are applicable to the situation and what cleanup goals are appropriate.

Chemicals of Concern Using very protective assumptions regarding concentration, distribution, toxicity, and potential routes of exposure, the BPHE identifies certain "chemicals of potential concern." The initial list of chemicals of concern included all chemicals that were detected in the chemical database for the period from 1987 through 1989 plus additional data for inorganic analysis from 1990 (see Appendix 2, Table 1). This list included twenty organic chemicals and two inorganic chemicals. Twenty-three analytes are listed since Chromium is included in two valence states.

The final list of chemicals of concern indentified in the BPHE for the AMD 915 site (Appendix 2, Table 3) includes 16 organic chemicals and 2 inorganic chemicals for a total of nineteen chemicals, since Chromium is again included in two valence states. Two organic chemicals were eliminated from consideration as chemicals of potential concern based on single detection of the chemicals. Only 1,2,4-TCB is retained as a chemical of concern due to uncertainty in the detection of other isomers of TCB, which eliminated two additional chemicals of concern which represented other isomers of TCB.

Exposure Scenarios Using similarly protective assumptions, the BPHE also develops current and future exposure scenarios. At the AMD 915 site, there are no current exposure scenarios. For the hypothetical future exposure scenarios, it was assumed that the AMD 915 site would be developed for residential use and that the groundwater in the shallow aquifer would be used as the sole source of drinking and domestic water at this site. According to the BPHE, potential **future exposure** routes at the AMD 915 site may include ingestion of groundwater, inhalation of VOC vapors during showering or other domestic uses, and ingestion of soil during construction of this hypothetical residential development.

According to the BPHE, if no further cleanup action were taken, and if current cleanup actions were halted, no **average exposure scenarios** were shown to present a non-carcinogenic or carcinogenic risk greater than the EPA allowable risk range. Based on average concentration data the carcinogenic risk from groundwater ingestion is estimated to be 6 per 100,000. The majority of this risk is related to the ingestion of arsenic at concentrations well below the Federal and State maximum contaminant levels (MCLs). For the average scenario the noncarcinogenic hazard index for the average case is less than 1 indicating that toxic health affects would not be expected from the domestic use of this groundwater.

A slightly elevated carcinogenic risk and an elevated hazard index is shown for the **maximum exposure scenario** (even more conservative assumptions.) The maximum exposure scenario was used to calculate cleanup goals and to calculate how protective each alternative might be. It should be emphasized that there are currently no known plans to use the on-site area for residential purposes. Nor is shallow groundwater currently used for local drinking water; local ordinances restrict use of the shallow groundwater for drinking water. In addition, the assumption that all cleanup actions will be discontinued is intended only to provide a baseline for comparison, and does not reflect the current situation or future plans for the AMD 915 site.

11. Chemicals Of Concern Chemicals of concern for the AMD 915 site include Arsenic, Benzene, Chloroform, Chromium (III), Chromium (VI), Dichlorodifluoromethane (Freon 12), 1,1-Dichloroethane (1,1-DCA), 1,1-Dichloroethylene (1,1-DCE), cis-1,2-Dichloroethylene (cis-1,2-DCE), trans-1,2-Dichloroethylene (trans-1,2-DCE), Ethylbenzene, Freon 113, Tetrachloroethylene (PCE), Toluene, 1,2,4-TCB, 1,1,1-Trichloroethane (1,1,1-TCA), TCE, Trichlorofluromethane (Freon 11), and xylenes.

Arsenic, Benzene, and Chromium (VI) are considered to be known human carcinogens (EPA Class A). Chloroform, 1,1-DCA, PCE and TCE are considered to be probable human carcinogens (EPA Class B2), and 1,1-DCE is considered to be possible human carcinogen (EPA Class

C). All of the chemicals listed have potential toxic effects, other than cancer, at some concentration.

12. Interim Remedial Actions, Soil Two interim remedial actions for soil were completed in 1981. The first of these was the removal of a waste solvent tank and Burmar vault in the Pad 4 area in June 1981. This excavation resulted in the removal of approximately 1500 cubic yards of soil. Analysis of soil for VOCs was not completed at the time of excavation. Additional investigation of the Pad IV area in July 1990 indicated that this action was successful and no soil with greater than 1 ppm of VOCs remain in place.

    The second action was completed in September 1981 with the removal of the acid neutralization system from the Pad "C" area north of the AMD 915 facility. The acid neutralization system and approximately 5500 cubic yards of soil were removed between December 21, 1981 and January 4, 1982. These materials were disposed of at an offsite commercial disposal facility.

13. Interim Remedial Actions, Groundwater Remediation of the groundwater began with extraction of groundwater from four building dewatering sumps which were inplace from the completion of the 915 building. These sumps only extract water from the shallowest or A aquifer and three of the sumps are still operating at present. In 1982 five groundwater extraction wells were installed, with four wells extracting water from the A and B1 aquifers and one well extracting water from the A, B1 and B2 aquifers. In 1984 four additional extraction wells were completed. These wells were combined with two best producing wells that had been installed in 1982 for a total of six extraction wells. The intent of these changes to the system was to improve control of offsite contaminant migration. An additional extraction well completed in the B2 aquifer was added in 1985. An eighth extraction well, again in the B2 aquifer, was added in 1988.

    The extracted groundwater is piped to a groundwater treatment system, consisting of two airstripping towers, one active, one reserve, and aqueous phase activated carbon filtration units. This treatment system was completed in January of 1984. The system has consistently removed from 90 to 99% of the VOCs from the groundwater. Approximately 30% of the extracted treated groundwater is reused as industrial process or cooling water, prior to release to the sanitary sewer. The remaining treated water is discharged to a storm sewer tributary of Calabazas Creek under NPDES Permit Number CA0028797.

14. Vertical Conduit Study A well search for abandoned wells in a 3350 acre area encompassing AMD 915 was completed in December 1986. This includes over one mile in all directions and over three miles in the downgradient direction. The focus of the well search was to

identify wells that potentially may form migration pathways to the deeper aquifer. The search identified 177 possible well locations. Of these wells 76 are identified as destroyed. Only four wells that might act as potential migration conduits to deeper aquifers were identified. Only one of these wells is downgradient of the AMD 915 site. This well is a Santa Clara Valley Water District (SCVWD) well more than 2000 feet downgradient of the site. Testing of the well has shown no evidence of contamination. Of the remaining three wells, two wells are listed as destroyed in SCVWD records. The remaining well is a cathodic protection well maintained by PG&E. This type of well is frequently installed to inhibit rust in underground pipelines. These wells are typically shallow (i.e. pipeline depth) and cased with steel. No additional data was available on the other well and attempts to field check the well location were unsuccessful.

Two municipal supply wells were identified by the potential conduit study. Well ID number 1845 is a City of Sunnyvale water supply well. This well is over 3000 feet upgradient of the known groundwater contamination plume. Well ID number T6SR1WS29N2 T6SR1WS29 is also upgradient of the groundwater pollution plume and is shown in Santa Clara Valley Water District records as destroyed.

The potential conduit survey was updated in 1989 with a new search of Santa Clara Valley Water District records to locate any wells that might have been installed since the completion of the potential conduit in 1986. This second search found eight wells, four of which had been destroyed. The remaining four wells are active monitor wells slotted in the shallow aquifer between 5 and 20 feet below ground surface. The four remaining wells due, to the shallow depth of completion, do not represent potential conduits for migration of contaminants to deeper aquifers.

15. Data Quality Development of the Board's final RAP was based on four criteria: 1) data was collected following an approved sampling and analysis plan, 2) random sample splits were collected by Board staff to confirm the validity of data generated by AMD, 3) AMD's data was validated by the Department of Health Services and found to be at least qualitatively acceptable, and 4) there has been reasonable repeatability of the data based on seven years of monitoring. Thus the Board finds that there is sufficient acceptable data to make cleanup decisions.

16. Description of Remedial Alternatives Initially, a large number of cleanup methods (technologies) were screened with respect to their effectiveness, implementability, and order-of-magnitude cost. The methods which passed this initial screening were then combined into cleanup alternatives most applicable to the AMD 915 site and evaluated in detail. The detailed analysis included an evaluation based on the nine criteria listed below:

- Overall protection of human health and the environment
- Compliance with ARARs
- Short-term effectiveness
- Long-term effectiveness
- Reduction of toxicity, mobility, or volume
- Implementability
- Cost
- State acceptance
- Community acceptance.

The four groundwater cleanup alternatives are detaioled here. The results of the nine criteria evaluation are presented in Finding 18.

Alternative 1: No Action - Monitoring The no action alternative includes completely stopping operation of the existing groundwater treatment system which has been operating for the last 6 years and imposes site restrictions on future use of the property. The present net worth cost of this alternative is estimated to be $1,500,000.00. It is uncertain when the groundwater would return to background levels.

Alternative 2: Extraction - Air Stripping and Liquid Phase Carbon Adsorption This alternative comprises the current interim remedial system for the groundwater (extraction wells, air stripper and liquid phase carbon adsorption). Air stripping as a stand-alone technology is very effective in removing VOCs from groundwater at the AMD 915 site. Further polishing of the air stripper effluent by carbon adsorption provides additional treatment. The treated water is reused on site and the excess is discharged to the storm drain under permit. The present net worth cost of this alternative is estimated to be $2,100,000.00. It is estimated that this alternative could reach MCLs in 12 years. The estimated time to achieve background levels of chemicals is 18 years at an estimated present net worth cost $2,800,000.00,

Alternative 3: Extraction - Carbon Adsorption Alternative This alternative consists of extraction of groundwater using the current well system. The extracted groundwater could then be passed directly through granular activated carbon designed for liquid phase adsorption of VOCs. Use of the air stripper would be discontinued. The treated water would be reused on site and the excess discharged to the storm drain under permit. The present net worth cost of this alternative is estimated to be $5,100,000.00. It is estimated that this alternative could reach MCLs in 12 years. The estimates to achieve background levels of chemicals is 18 years at an estimated present net worth cost $6,700,000.00.

Alternative 4: Extraction - UV/H_2O_2 Oxidation This alternative consists of extraction of groundwater using the current network of wells. Oxidation enhancers such as hydrogen peroxide (H_2O_2) would be mixed with the groundwater which is then exposed to ultraviolet light in the reactor. The reactor offgas would be treated by a catalytic oxidizer to ensure compliance. The treated groundwater would be recycled into onsite operations and the excess disposed of to the storm drain. The present net worth cost of this alternative is estimated to be $4,000,000.00. It is estimated that this alternative could reach MCLs in 12 years. The estimates to achieve background levels of chemicals is 18 years at an estimated present net worth cost $5,100,000.00.

17. Evaluation of Remedial Alternatives As previously mentioned, the alternatives for each Operable Unit were evaluated using the nine FS criteria. Table 2 summarizes the results of the evaluation using the first seven criteria; evaluation of community and agency acceptance is deferred until after the public comment period. A brief comparison of the alternatives follows.

Proposed Alternative

The proposed final remedial system for the AMD 915 site is Alternative 2. Alternative 2, is Extraction and Groundwater Treatment with Existing Air Stripper and Liquid Phase Carbon Adsorption. This system comprises the existing interim cleanup measure and, thus, has demonstrated its effectiveness. It provides protection of human health and the environment by removing the VOCs from the groundwater, complies with ARARs, is effective in both the long-and short-term, reduces the volume and mobility of the contaminants, and is cost-effective.

The selection of Alternative 2 is based on similar performance between the alternatives but the lower estimated cost of Alternative 2 and its demonstrated effectiveness and reliability.

In addition to the above components staff proposes the inclusion of institutional constraints in the form of a deed restriction. The purpose of the deed restriction should be to control site access and prevent the installation of water supply wells in the shallow water-bearing zones and to provide a warning for any subsurface construction activities. The deed restriction would be designed to "run with" the property to insure that any potential future site occupants would be aware of the past contamination at the site.

Rejected Alternatives

Alternative 1, the no action alternative would not be protective of human health or the environment. This alternative was carried forward for comparative purposes and would not be an appropriate

cleanup action. No further consideration will be given to this alternative.

Alternative 3 is groundwater extraction and treatment with carbon adsorption. This Alternative differs from Alternative 2 only in treating with solely aqueous phase carbon. This alternative offers increased permanent destruction of the contaminants through the carbon regeneration process. However this alternative is significantly more costly than the other alternatives.

Alternative 4 is groundwater extraction and treatment with a ultraviolet/oxidation process. This is an innovative technology which has been demonstrated at several sites in the South Bay on similar contaminants. This treatment technology is also would provide an improvement in permanent destruction of the contaminants. The technology has not been demonstrated on the volumes required for the AMD 915 treatment facility. Implementability and reliability may be in question. The cost of this alterative is greater than Alterative 2 but less than Alternative 3.

In summary the proposed final RAP would include the following components:

1. Continued groundwater monitoring,

3. Continued groundwater extraction and treatment with the existing system at AMD 915,

3. Implementation of institutional constraints for the AMD 915 property until cleanup standards are achieved.

18. Cleanup Standards The cleanup standards must meet all applicable, relevant and appropriate requirements (ARARs) and be protective of human health and the environment. Based on the results of the RI no further soil remediation is anticipated.

After further review it was determined that arsenic was not present at concentrations or in frequency of occurrence that could be considered to be significantly different from background levels of arsenic. Therefore no cleanup standard for arsenic is included in this Order. Cleanup standards for groundwater are shown in Appendix 2, Table 4 of this Order. The standards for chemicals of concern identified at AMD 915 shall be the more stringent of the Federal or California maximum contaminant level (MCLs) for drinking water. Since groundwater cleanup levels are based on MCLs this will meet all ARARs for groundwater cleanup.

An additional concern that is discussed in the FS is the potential contamination of the air at the AMD 915. The appropriate standards for this consideration are the regulations of the Bay Area Air Quality Management District (BAAQMD) Regulation 8, Rule 47 which is an ARAR for this facility. The air stripper system at AMD 915 DeGuigne Drive site is regulated by the BAAQMD. The air stripper offgas at AMD 915 is not treated. The air emissions from these units do satisfy the ARAR cited above as regulated by the BAAQMD.

19. Risk Associated With Cleanup Standards The selected remedy is protective of human health and the environment, as required by Section 121 of CERCLA, in that pollution in groundwater is treated to at least MCLs and falls within EPA's acceptable carcinogenic risk range and noncarcinogenic hazard index. EPA's acceptable carcinogenic risk range for cleanup standards selected for a site is 10^{-4} to 10^{-6} as an acceptable cleanup level. If the noncarcinogenic hazard index is less than one, EPA considers the combined intake of chemicals unlikely to pose a health risk.

At AMD 915 the carcinogenic risk after cleanup for all chemical of concern associated with the potential future use scenario of thirty years of groundwater ingestion and inhalation of VOCs is 7×10^{-5}. In cleaning up TCE and 1,1-DCE, the dominant chemicals in mass and concentration, to their respective MCLs of 5.0 µg/l and 6.0 µg/l, it is quite likely that the concentrations of other VOCs will be reduced to levels below the cleanup criteria. This risk estimate is based on cleanup to MCL levels or current maximum concentration when these maximum concentrations are less than MCLs. This is an attempt to provide a more realistic estimate of the residual risk after cleanup is achieved.

The noncarcinogenic hazard index associated with the cleanup standards at AMD 915 for the representative or average case is 0.25 and 0.36 for the maximum case. This is indicative that no toxic effects would be expected from the domestic use of groundwater after cleanup at the AMD 915 facility.

The health hazard and risk estimates above include 1,1-DCE which is classified by the EPA only as a possible human carcinogen. This classification is currently under review and the California Department of Health Services (DOHS) does not recommend including 1,1-DCE in risk calculations as a carcinogen. Based on the recommendation of DOHS and with guidance from EPA Region IX the risk after cleanup has also been evaluated without the inclusion of 1,1-DCE as a carcinogen. Under EPA Region IX guidance 1,1-DCE is summed in the hazard index with a more protective reference dose to provide additional consideration of possible carcinogenic effects. The carcinogenic risk without 1,1-DCE is 4×10^{-6} for the average or representative case and 2×10^{-5} for the maximum plausible case. The revised hazard indices are 0.37 for the average case and 0.53

for the maximum case.

The method and assumptions used to obtain the carcinogenic risk and the hazard index associated with the cleanup standards are contained in the FS. A number of assumptions have been made in the derivation of these values, many of which are intentional overestimates of exposure and/or toxicity. The actual incidence of cancer is likely to be lower than these estimates and may even be zero. The cleanup standards for the site are protective of human health, have a carcinogenic risk that falls within a range of 10^{-6} to 10^{-4}, and a hazard index of less than one.

20. Uncertainty in Achieving Cleanup Standards The goal of this remedial action is to restore groundwater to its beneficial uses. Based on information obtained during the RI and on a careful analysis of all remedial alternatives, the Board believes that the selected remedy will achieve this goal. However, studies suggest that groundwater extraction and treatment will not be, in all cases, completely successful in reducing contaminants to health-based levels in the aquifer zones. The Board recognizes that operation of the selected extraction and treatment system may demonstrate the technical impracticability of reaching health-based groundwater quality standards using this approach. If it becomes apparent, during implementation or operation of the system, that contaminant levels have ceased to decline and are remaining constant at levels higher than the remediation goal, that goal and the remedy may be reevaluated.

The selected remedy will include groundwater extraction for a period of up to 12 years at AMD 915, during which the system performance will be carefully monitored on a regular basis and adjusted as warranted by the performance data collected during operation. Modifications may include:

a) discontinuing operation of extraction wells in areas where cleanup standards have been attained;

b) alternating pumping at wells to eliminate stagnation points; and

c) pulse pumping to allow aquifer equilibration and encourage adsorbed contaminants to partition into groundwater.

The projected times to achieve cleanup included in this Tentative Order are developed in the FS. These times are derived from a simple groundwater model and are intended to provide a basis of comparison for the screening of alternatives. It is probable that this model provides an underestimate of the time required to achieve the cleanup standards proposed in this Order.

21. Future Changes to Cleanup Levels If new information indicates cleanup standards cannot be attained or can reasonably be surpassed, the Regional Board will decide if further final cleanup actions beyond those completed shall be implemented at this site. If changes to the cleanup standards or amended cleanup standards are proposed, due to the claimed technical infeasibility of attaining the standards, adopted by this Order, a new Order will be submitted to the Board for consideration and to EPA Region IX for their concurrence. If changes in health criteria, administrative requirements, site conditions, or remediation efficiency occur, the discharger will submit an evaluation of the effects of these changes on cleanup levels as specified under Provisions C.4.g.

The Regional Board will not require the discharger to undertake additional remedial actions with respect to the matters previously described herein unless: (1) conditions on the site, previously unknown to the Regional Board, are discovered after adoption of this Order, or (2) new information is received by the Regional Board, in whole or in part after the date of this Order, and these previously unknown conditions or this new information indicates that the remedial actions required in this Order may not be protective of public health and the environment. The Regional Board will also consider technical practicality, cost effectiveness, State Board Resolution No. 68-16 and other factors evaluated by the Regional Board in issuing this Order in determining whether such additional remedial actions are appropriate and necessary.

22. Community Involvement An aggressive Community Relations program has been ongoing for all Santa Clara Valley Superfund sites, including AMD 915. The Board published a notice in the San Jose Mercury News on March 13,20, and 27, 1991, announcing the proposed final cleanup plan and opportunity for public comment at the Board Hearing of March 20, 1991 in Oakland, and announcing the opportunity for public comment at an evening public meeting to be held at the Westinghouse Auditorium, Britton at East Duane Avenue, in the City of Sunnyvale on Thursday March 28, 1991. Public comment was received during an extended 60 day period (at community request) from March 20 through May 20, 1991.

Fact Sheets were mailed to interested residents, local government officials, and media representatives. Fact Sheet 1, mailed in december 1989, summarized the pollution problem, the results of investigations to date, and the interim remedial actions. Fact Sheet 2, mailed in March 1991, described the cleanup alternatives evaluated, explained the proposed final cleanup plan, announced opportunities for public comment at the Board Hearing of March 20, 1991 in Oakland and the Public Meeting of March 28, 1991 in Sunnyvale and described the availability of further information at the Information Repository at the City of Sunnyvale Library and the Regional Board offices. The attached Responsiveness Summary

(Appendix C) contains comments and responses and any modifications to the proposed cleanup plan that result from these comments.

23. State Board Resolution No. 68-16, "Statement of Policy with Respect to Maintaining High Quality Waters in California" On October 28, 1968, the State Water Resources Control Board adopted Resolution No. 68-16, "Statement of Policy with Respect to Maintaining High Quality Waters in California". This policy calls for maintaining the existing high quality of State waters unless it is demonstrated that any change would be consistent with the maximum public benefit and not unreasonably affect beneficial uses. The original discharge of waste to the groundwater at these sites was in violation of this policy; therefore, the groundwater quality needs to be restored to its original quality to the extent reasonable. For the purpose of establishing cleanup objectives, the shallow groundwater at the site is designated a potential source of drinking water (see finding 7).

The FS evaluated groundwater cleanup to background or non-detect levels. Cleanup to non-detect levels would increase estimated groundwater cleanup times by over 50% and add significantly to cost. The FS also evaluated cleanup levels necessary to achieve a 1 in 1,000,000 excess cancer risk from future ingestion of the groundwater. This is highly impractical due to the presence of arsenic. The arsenic concentration would have to be reduced to 1.5 μg/l to approach the 1 in a 1,000,000 excess cancer risk. This is far below the current MCL for arsenic of 50 μg/l and is probably below the naturally occurring background of arsenic in groundwater in Santa Clara County.

In addition, cleanup of groundwater to below the MCL for the chemicals of concern may not be achievable due to the technical difficulties in restoring aquifers by the removal of low concentrations of any VOC. This is due to the slow desorption of VOCs adsorbed to the inner pore spaces of soil particles which make up the aquifer material and VOCs adsorbed to clays and organic matter in the aquitard. Cleanup to MCL levels would protect the primary beneficial use of the groundwater as a potential source of drinking water. For these reasons, MCLs were accepted as concentrations that meet the intent of Resolution No. 68-16.

The proposed remedial water quality standards meet current applicable health criteria and restore the quality of the groundwater to the extent reasonable given technical and economic constraints. These constraints include the high additional incremental costs for removal of small amounts of additional chemicals and the need to minimize the removal of groundwater to achieve acceptable remedial standards.

24. Groundwater Conservation AMD has considered the feasibility of

reclamation, reuse, or discharge to a publicly owned treatment works (POTW) of extracted groundwater from AMD 915, as specified in Board Resolution No. 88-160. Onsite industrial reuse accounts for approximately 30% of the water after treatment.

The extracted groundwater from an offsite remedial groundwater extraction system, unrelated to the contamination at AMD 915, is also piped to AMD 915 for treatment. Reuse at the AMD 915 facility, which includes water from this offsite remedial groundwater extraction system, currently is at about 30% of the total volume. It is anticipated that this reuse will reach 80% during 1991 with an eventual goal of 100% reuse.

25. Basin Plan The Board adopted a revised Water Quality Control Plan for the San Francisco Bay Basin (Basin Plan) on December 17, 1986. The Basin Plan contains water quality objectives and beneficial uses for South San Francisco Bay and contiguous surface and ground waters.

26. Beneficial Use The existing and potential beneficial uses of the groundwater underlying and adjacent to the facility include:

    a. Industrial process water supply
    b. Industrial service water supply
    c. Municipal and Domestic water supply
    d. Agricultural water supply

27. The discharger has caused or permitted, and threatens to cause or permit waste to be discharged or deposited where it is or probably will be discharged to waters of the State and creates or threatens to create a condition of pollution or nuisance.

28. This action is an order to enforce the laws and regulations administered by the Board. This action is categorically exempt from the provisions of the CEQA pursuant to Section 15321 of the Resources Agency Guidelines.

29. Onsite and offsite interim containment and cleanup measures need to be continued to alleviate the threat to the environment posed by the continued migration of pollutants and to provide a substantive technical basis for designing and evaluating the effectiveness of final cleanup alternatives.

30. The Board has notified the discharger and interested agencies and persons of its intent under California Water Code Section 13304 to prescribe Site Cleanup Requirements for the discharge and has provided them with the opportunity for a public hearing and an opportunity to submit their written views and recommendations.

31. The Board, in a public meeting on June 19, 1991, heard and

considered all comments pertaining to the discharge.

IT IS HEREBY ORDERED, pursuant to Section 13304 of the California Water Code, that the discharger, their agents, assignees, or successors, shall cleanup and abate the effects described in the above findings as follows:

A. **PROHIBITIONS**

1. The discharge of wastes or hazardous materials in a manner which will degrade water quality or adversely affect the beneficial uses of the waters of the State is prohibited.

2. Further significant migration of pollutants through subsurface transport to waters of the State is prohibited.

3. Activities associated with the subsurface investigation and cleanup which will cause significant adverse migration of pollutants are prohibited.

B. **SPECIFICATIONS**

1. The storage, handling, treatment or disposal of soil or groundwater containing pollutants shall not create a nuisance as defined in Section 13050(m) of the California Water Code.

2. The discharger shall conduct monitoring activities as outlined in the amended sampling plan, approved by the Executive Officer, to define the current local hydrogeologic conditions, and the lateral and vertical extent of soil and groundwater pollution. Should monitoring results show evidence of pollutant migration, additional characterization of pollutant extent may be required.

3. Pursuant to Water Code Section 13304(c), the dischargers are hereby notified that the Board is entitled to and may seek reimbursement for all reasonable staff oversight costs incurred relating to cleanup of waste on this site, abating the effects thereof, or taking other remedial action.

C. **PROVISIONS**

1. The discharger shall submit to the Board acceptable monitoring program reports containing results of work performed according to a program as described in the October 1989 field sample and analysis plan, or as amended, and approved by the Executive Officer.

2. All wells at the AMD 915 site shall be used to determine if cleanup standards have been met.

3. Final cleanup standards for all onsite and offsite wells shall be not greater than the levels as provided in Finding 18 and as shown in Appendix 2, Table 4.

4. The discharger shall comply with the Prohibitions and Specifications above, in accordance with the following time schedule and tasks:

COMPLETION DATE/TASK

a. TASK 1: PROPOSED CONSTRAINTS: Submit a technical report acceptable to the Executive Officer documenting procedures to be implemented by the dischargers, including a deed restriction prohibiting the use of the upper aquifer groundwater as a source of drinking water, and for controlling onsite activities that could endanger the public health or the environment due to exposure to VOCs. Constraints shall remain in effect until groundwater cleanup standards have been achieved and pollutant levels have stabilized in onsite aquifers.

COMPLETION DATE: July 28, 1991

b. TASK 2: CONSTRAINTS IMPLEMENTED: Submit a technical report acceptable to the Executive Officer documenting that the proposed and approved constraints have been implemented.

COMPLETION DATE: 60 days after Board staff approval of Task 1.

c. UPDATING ADMINISTRATIVE RECORD:

1) TASK 3: PROPOSED UPDATE: Submit a technical report acceptable to the Executive Officer containing an updated index for the Administrative Record for the period November 1, 1990 through September 30, 1991.

COMPLETION DATE: October 15, 1991

2) TASK 4: UPDATE ADMINISTRATIVE RECORD: Submit a technical report acceptable to the Excutive Officer containing the updated Administrative Record documents for the period November 1, 1990 through September 30, 1991.

COMPLETION DATE: December 1, 1991

d. TASK 5: ONSITE WELL PUMPING CURTAILMENT CRITERIA AND PROPOSAL: Submit a technical report acceptable to the Executive Officer containing a proposal for curtailing pumping from onsite groundwater extraction well(s) and trench(s) and the criteria used to justify such curtailment. This report shall include data to show that cleanup standards for all VOCs have been achieved and have stabilized or are stabilizing, and that the potential for pollutant levels rising above cleanup standards is minimal. This report shall also include an evaluation of the potential for pollutants to migrate downwards to the C aquifer at this location. If the discharger claims that it is not technically feasible to achieve cleanup standards, the report shall evaluate the alternate standards that can be achieved. Cessation of pumping will require the concurrence of the Regional Board and EPA, should either party not concur, continued pumping will be required.

COMPLETION DATE: 90 days prior to proposed implementation of onsite groundwater extraction curtailment

e. TASK 6: IMPLEMENTATION OF ONSITE CURTAILMENT: Submit a technical report acceptable to the Executive Officer documenting completion of the necessary tasks identified in the technical report submitted for Task 5.

COMPLETION DATE; 30 days after the Regional Board approves onsite curtailment

f. TASK 7: FIVE-YEAR STATUS REPORT AND EFFECTIVENESS EVALUATION: Submit a technical report acceptable to the Executive Officer containing the results of any additional investigation including the soil remediation study; an evaluation of the effectiveness of installed final cleanup measures and cleanup costs; additional recommended measures to achieve final cleanup objectives and standards, if necessary; a comparison of previous expected costs with the costs incurred and projected costs necessary to achieve cleanup objectives and standards; and the tasks and time schedule necessary to

implement any additional final cleanup measures.

This report shall also describe the reuse of extracted groundwater, evaluate and document the cleanup of polluted groundwater, and evaluate and document the removal and/or cleanup of polluted soil. If safe drinking water levels, through the removal of the chemicals for which this Order specifies cleanup standards, have not been achieved onsite and are not expected to be achieved through continued groundwater extraction and/or soil remediation, this report shall also contain an evaluation addressing whether it is technically feasible to achieve drinking-water quality onsite, and if so, a proposal for procedures to do so.

COMPLETION DATE: June 19, 1996

g. TASK 8: EVALUATION OF NEW HEALTH CRITERIA: Submit a technical report acceptable to the Executive Officer which contains an evaluation of how the final plan and cleanup standards would be affected, if the concentrations as listed in Appendix 2, Table 4 change as a result of changes in source-document conclusions or promulgation of drinking water standards, maximum contaminant levels or action levels.

COMPLETION DATE: 60 days after request made by the Executive Officer

3. All Technical reports submitted must be acceptable to the Executive Officer. The submittal of technical reports evaluating interim and final remedial measures shall include a projection of the cost, effectiveness, benefits, and impact on public health and the environment.

4. If the discharger is delayed, interrupted or prevented from meeting one or more of the completion dates specified in this Order, the discharger shall notify the Executive Officer prior to the deadline for the completion date.

5. Technical reports summarizing the status of compliance with the Prohibitions, Specifications, and Provisions of this Order and progress toward completion of tasks shall be submitted on a quarterly basis, according to the schedule below, commencing with the report for the third quarter 1991, due October 31, 1991.

Quarter	1st quarter	2nd Quarter	3rd Quarter	4th Quarter
Period	Jan-March	April-June	July-Sept	Oct-Dec
Due Date	April 30	July 31	October 31	January 31

The quarterly reports shall include;

a. a summary of work completed since the previous quarterly report,
b. appropriately scaled and labeled maps showing the location of all monitoring wells, extraction wells, and existing structures,
c. updated water table and piezometric surface maps for all affected water bearing zones, and isoconcentration maps for key pollutants in all affected water bearing zones, shall be included at a minimum in the reports for the second and fourth quarters, or in the event of significant changes,
d. a summary tabulation of all well construction data, groundwater levels and chemical analysis results for site monitor wells as specified in the revised sampling plan,
e. a summary tabulation of volume of extracted groundwater and results of chemical analysis for all site groundwater extraction wells,
f. an estimate of volume or mass of contaminants removed by each remedial system during the quarter and a cumulative tabulation of total volume or mass of contaminants removed from the groundwater (# total & #/day),
g. identification of potential problems which will cause or threaten to cause noncompliance with this Order and what actions are being taken or planned to prevent these obstacles from resulting in noncompliance with this Order, and
h. in the event of noncompliance with the Provisions and Specifications of this Order, the report shall include written justification for noncompliance and proposed actions to achieve compliance.

7. All hydrogeological plans, specifications, reports, and documents shall be signed by or stamped with the seal of a registered geologist, engineering geologist or professional engineer.

8. All samples shall be analyzed by State certified laboratories or laboratories accepted by the Board using approved EPA methods for the type of analysis to be performed. All laboratories shall maintain Quality Assurance/Quality Control records for Board review.

9. The discharger shall maintain in good working order, and operate, as efficiently as possible, any facility or control system installed to achieve compliance with the requirements of this Order.

10. Copies of all correspondence, reports, and documents pertaining to compliance with this Order, shall be provided to the following agencies:

    a. Santa Clara Valley Water District
    b. Santa Clara County Health Department
    c. City of Sunnyvale
    d. State Department of Health Services/TSCD
    e. U. S. EPA Region IX, H-6-3

    The Executive Officer may additionally require copies of correspondence, reports and documents pertaining to compliance with the Prohibitions, Specifications, and Provisions of this Order to be provided to a local repository for public use.

11. The discharger shall permit the Board or its authorized representative, in accordance with Section 13267(c) of the California Water Code:

    a. Entry upon premises in which any pollution sources exist, or may potentially exist, or in which any required records are kept, which are relevant to this Order.

    b. Access to copy any records required to be kept under the terms and conditions of this Order.

    c. Inspection of any monitoring equipment or methodology implemented in response to this Order.

    d. Sampling of any groundwater or soil which is accessible, or may become accessible, as part of any investigation or remedial action program undertaken by the discharger.

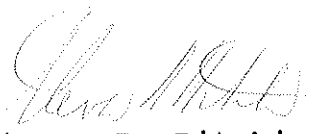
12. The discharger shall file a report on any changes in site occupancy and ownership associated with the facility described in this Order.

13. If any hazardous substance is discharged to any waters of the state, or discharged and deposited where it is, or probably will be discharged to any waters of the state, the discharger shall report such discharge to this Regional Board, at (415) 464-1255 on weekdays during office hours from 8 a.m. to 5 p.m., and to the Office of Emergency Services at (800) 852-7550 during non-business hours. A written report shall be filed with the Regional Board within five (5) working days and

shall contain information relative to: the nature of waste or pollutant, quantity involved, duration of incident, cause of spill, Spill Prevention, Control, and Countermeasure Plan (SPCC) in effect, if any, estimated size of affected area, nature of effect, corrective measures that have been taken or planned, and a schedule of these activities, and persons/-agencies notified.

14. The Board will review this Order periodically and may revise the requirements when necessary.

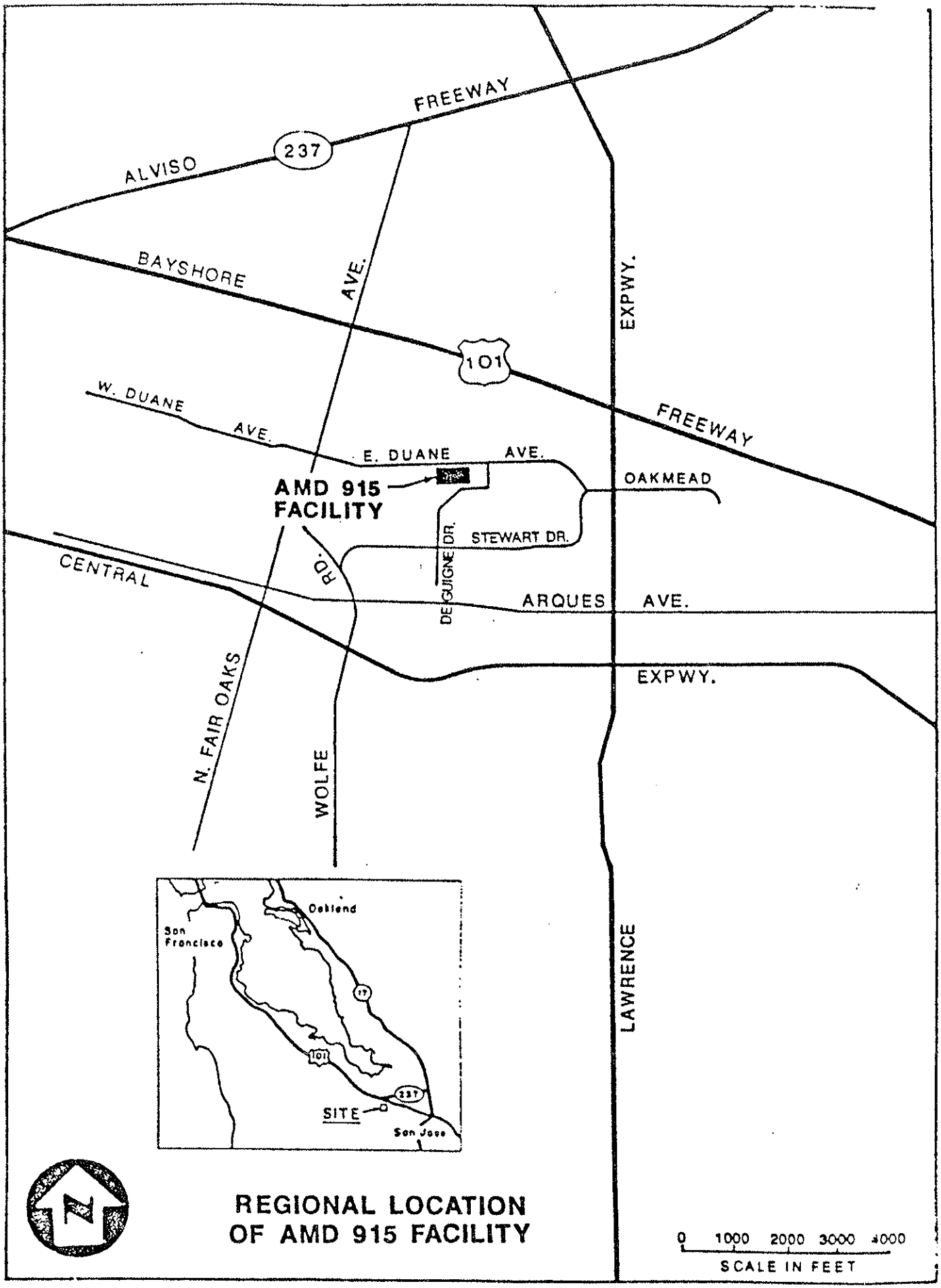
I, Steven R. Ritchie Executive Officer, do hereby certify that the foregoing is a full, true and correct copy of an Order adopted by the California Regional Water Quality Control Board, San Francisco Bay Region, June 19, 1991.



Steven R. Ritchie
Executive Officer

Attachments: Appendix 1 - Figures 1-3
Appendix 2 - Tables 1-4

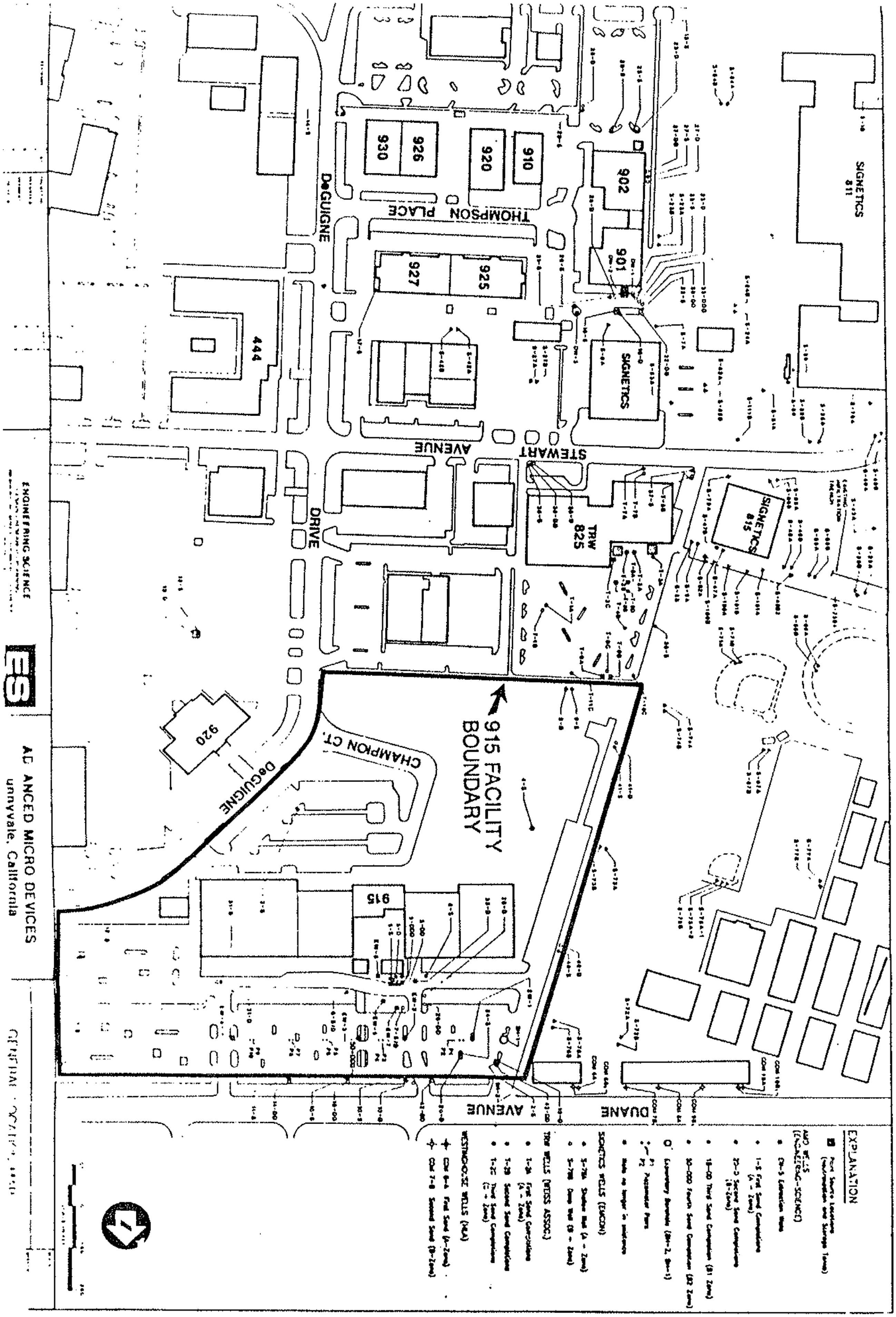
APPENDIX 1



REGIONAL LOCATION OF AMD 915 FACILITY

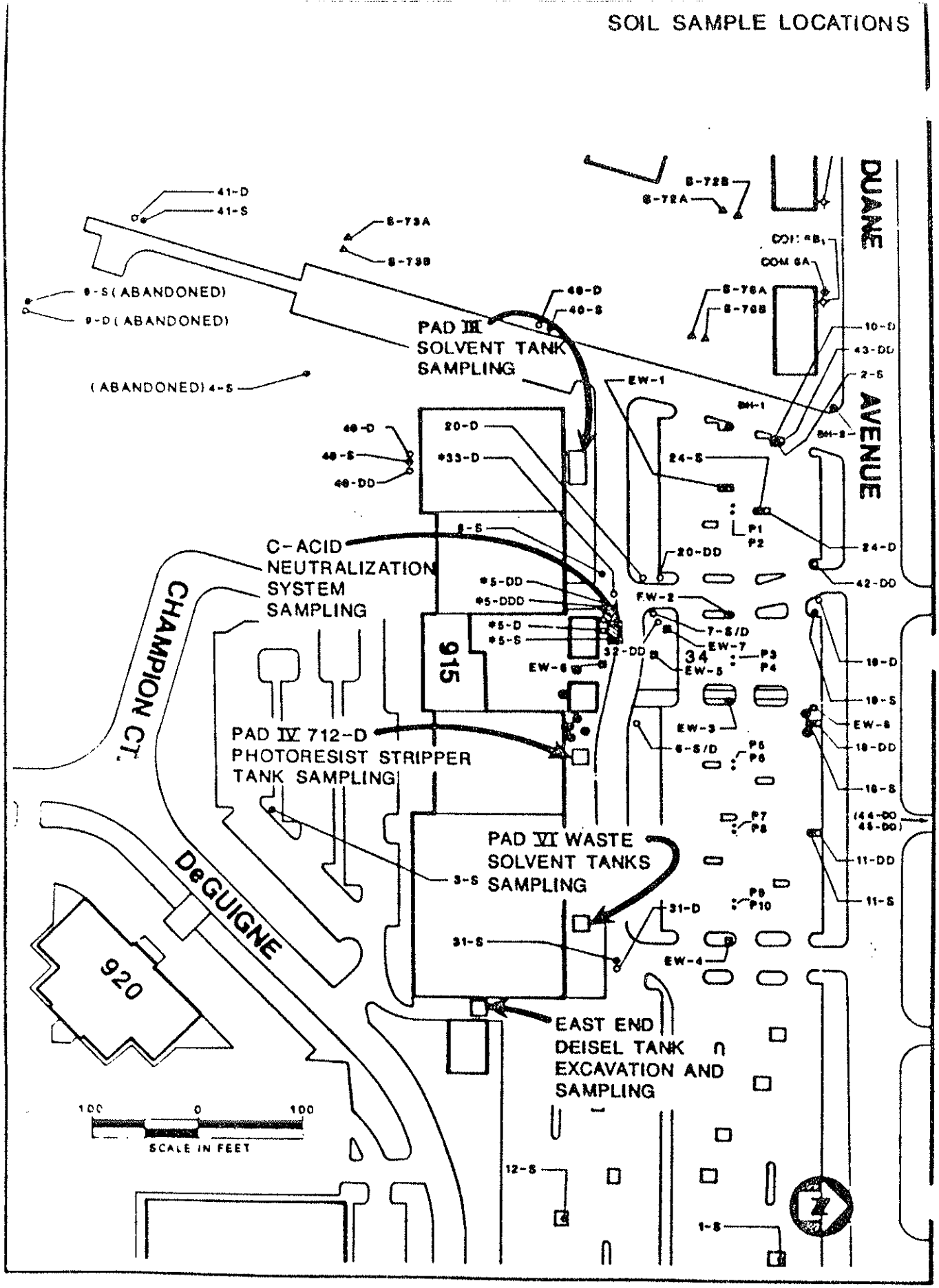
ENGINEERING-SCIENCE

Figure 1



915 FACILITY BOUNDARY
THOMPSON PLACE
STEWART AVENUE
DeGUIGNE DRIVE
DeGUIGNE
CHAMPION CT.
DUANE AVENUE
SIGNETICS 811
SIGNETICS 815
SIGNETICS
TRW 825
930
926
920
910
902
901
927
925
444
915
920
EXPLANATION
ES
ENGINEERING SCIENCE

Figure 2



ENGINEERING-SCIENCE

Figure 3

APPENDIX 2

TABLE 1

DATA SUMMARY FOR AMD BUILDING 915

Chemical	Tox Class	CRAVE	*GROUNDWATER (UG/L)* Rep Value	Max Value	#Det/ #Anal	*SOIL (UG/KG)* Rep Value	Max Value	#Det/ #Anal
Arsenic	PC/NC	A	10.97	14.1	6/21	ND	ND	0/14
Benzene	PC/NC	A	ND	ND	0/9	104.89	460	12/18
Chloroform	PC/NC	B2	1.54	4.3	17/126	ND	ND	0/14
Chromium (III)[1]	NC	D	93.63	653	16/21	ND	ND	0/14
Chromium (VI)[1]	PC/NC	A	93.63	653	16/21	ND	ND	0/14
Dibromochloromethane	PC/NC	B2	0.90	1.8	1/126	ND	ND	0/14
Dichlorodifluoromethane	NC	D	23.00	37	2/126	ND	ND	0/14
1,1-Dichloroethane	PC/NC	B2	1.93	4.5	17/126	ND	ND	0/14
1,1-Dichloroethene	PC/NC	C	7.90	50	36/126	ND	ND	0/14
cis-1,2-Dichloroethene	NC	D	85.04	450	79/126	ND	ND	0/14
trans-1,2-Dichloroethene	NC	D	1.27	2.1	7/126	ND	ND	0/14
cis-1,3-Dichloropropene	NC[2]	D[2]	375	750	1/126	ND	ND	0/14
Ethylbenzene	NC	D	ND	ND	0/9	50.00	100	1/4
Freon 113	NC	D	24.80	260	73/126	1,634.69	9,600	32/45
Tetrachloroethene	PC/NC	B2	0.95	1.9	1/126	19.00	38	1/14
Toluene	NC	D	2.00	4	1/9	24.50	110	11/18
Total Trichlorobenzenes	NC	D	NA	NA	NA	8,258.82	96,000	43/75
Trichlorobenzenes (specified as not 1,2,4-isomer)	NC	D	NA	NA	NA	3,512.50	36,000	9/16
1,2,4-Trichlorobenzene	NC	D	1.8	3.6	1/5	7,433.04	60,000	44/83
1,1,1-Trichloroethane	NC	D	13.33	44	41/126	0.70	0.7	2/49
Trichloroethene	PC/NC	B2	252.67	3,800	105/126	643.97	2,800	39/49
Trichlorofluoromethane	NC[2]	D[2]	0.88	1.2	4/126	ND	ND	0/14
Xylene	NC	D	ND	ND	0/9	92.31	310	14/17

NA - Not Analyzed
PC - Potential Carcinogen
NC - Noncarcinogen

ND - Not Detected CRAVE - Carcinogen Rise Assessment Verification Endeavor (see Table 2.2)
#Det - Number of Detected Values
#Anal - Number of Analyses
[1]Total chromium was reported.
[2]No information available On the carcinogenity of this compound.

TABLE 2

EVALUATION OF REMEDIAL ACTION ALTERNATIVES FOR THE AMD OPERABLE UNIT

Remedial Alternative	Protection of Human Health Environment (1)	Compliance with ARARs	Long-term Effectiveness	Reduction in Toxicity, Mobility and Volume	Short-term Effectiveness (2)	Implementability	Cost Present Value (3)
1 No Action/Monitoring	Not Protective	Not for hundreds of years	Not Effective	No reduction of T.M.V.	No increased exposure risk	Implementable	$1.5 million
2 Air Stripping and Liquid Phase Carbon Adsorption	Protective CR = IE-4 HI = 0.4	Yes	Effective	Long term reduction of T.M.V.	No increased exposure risk GCT, RG = 12 GCT, RG = 18	Implementable	$2.1/$2.8 million
3 Carbon Adsorption Alternative	Not Protective	Yes	Not Effective	Long Term reduction of T.M.V.	No increased exposure risk GCT, RG = 12 GCT, BG = 18	Implementable	$5.1/$6.7 million
4 Ultraviolate/Oxidation	Protective CR = IE-4 HI = 0.4	Yes	Effective	Long term reduction of T.M.V.	No increased exposure risk GCT, RG = 12 GCT, BG = 18	Implementable	$4.0/$5.1 million

Note: The preferred alternative is shaded

(1) CR= Carcinogenic risk for domestic use of groundwater from combined A/B aquifers; calculations include: 1,1-dichloroethene and are for the maximum scenario.
HI= Hazard Index (see text)

(2) GCT, RG = Groundwater Cleanup Times to clean up to remedial goals
GCT, BG = Groundwater Cleanup Times to clean up to background

(3) Costs given for cleanup to groundwater remedial goals (first cost) and to background (second cost).

TABLE 3

CLEANUP GOALS FOR THE CHEMICALS OF CONCERN IN GROUNDWATER AMD 915 SUNNYVALE, CALIFORNIA

Indicator Chemical	Federal MCL[1] (µg/l)	Federal WQC[b,3] (µg/l)	California MCL[6] (µg/l)
Arsenic	50	0(0.025)	50
Benzene	5	0(0.67)	1
Chromium (III)	50[b](100[b,p,2])	50.0	100[j,g]
Chromium (VI)	50[b](100[b,p,2])	170,000	50[b]
Chloroform	100[a]	0(0.19)[c]	50[b]
Dichlorodifluoromethane	---	0(0.19)[c]	g
1,1-Dichloroethane	---	[d]	5
1,1-Dichloroethene	7	0(0.033)	6
Cis-1,2-Dichloroethene	70[p,2]	[d]	6
Trans-1,2-Dichloroethene	100[p,2]	[d]	10
Ethylbenzene	700[p,2]	2,400	680
Freon 113	---	---	1,200
Tetrachloroethene	5[p,2]	0(0.88)	5
Toluene	2,000[p,2]	15,000	g
1,2,4-Trichlorobenzene	9[p,10]	---	h
1,1,1-Trichloroethane	200	19,000	200
Trichloroethene	5	0(2.8)	5
Trichlorofluoromethane	---	0(0.19)[c]	150
Xylenes (total)	10,000[p,2]	---	1,750[j]

a) Value is for Total Trihalomethanes.
b) MCLs and MCLGs for Chromium not specific to oxidation state.
c) Concentrations in parentheses correspond to midpoint of the risk range for potential carcinogens only. These numbers have been adjusted for drinking water only.
d) Value for "Halomethanes."
g) Unregulated; monitoring required for all community and non-transient, non-community water systems.
h) Unregulated; monitoring required for all community and non-transient, non-community water systems if determined vulnerable
j) Either for a single isomer or for the sum of the isomers.
p) Proposed; No data.

1) Source: 40 CFR, Parts 141, 142, 143. *National Primary & Secondary Drinking Water Regulations* U.S. EPA, Office of Drinking Water, 4/10/89; unless otherwise noted.
2) Source: *EPA Proposed National Primary & Secondary Drinking Water Regulations 54 FR 22062*, May 22, 1989
3) Source: *EPA Superfund Public Health Evaluation Manual*, October 1986; unless otherwise noted.
6) Department of Health Services Maximum Contaminant Levels and Action Levels for Contaminants in Drinking Water - October 24, 1990.

TABLE 4
CLEANUP GOALS FOR THE CHEMICALS OF CONCERN IN GROUNDWATER
AMD 915 SUNNYVALE, CALIFORNIA

Indicator Chemical	Federal MCL[1] (mg/l)	Federal WQC [b,3] (mg/l)	California MCL[6] (mg/l)
Benzene	5	0(0.67)	1
AChromium (III)	50[b](100[b,p,2])	50.0	100[a,g]
Chromium (VI)	50[b](100[b,p,2])	170,000	50[b]
Chloroform	100[a]	0(0.19)[c]	50[b]
Dichlorodifluoromethane	---	0(0.19)[c]	[g]
1,1-Dichloroethane	---	[d]	5
1,1-Dichloroethene	7	0(0.033)	6
Cis-1,2-Dichloroethene	70[p,2]	[d]	6
Trans-1,2-Dichloroethene	100[p,2]	[d]	10
Ethylbenzene	700[p,2]	2,400	680
Freon 113	---	---	1,200
Tetrachloroethene	5[p,2]	0(0.88)	5
Toluene	2,000[p,2]	15,000	[g]
1,2,4-Trichlorobenzene	9[p,1]	---	[h]
1,1,1-Trichloroethane	200	19,000	200
Trichloroethene	5	0(2.8)	5
Trichlorofluoromethane	---	0(0.19)[c]	150
Xylenes (total)	10,000[p,2]	---	1,750[j]

a)Value is for Total Trihalomethanes.
b)MCLs and MCLGs for Chromium not specific to oxidation state.
c)Concentrations in parentheses correspond to midpoint of the risk range for potential carcinogens only. These numbers have been adjusted for drinking water only.
d)Value for "Halomethanes."
g)Unregulated; monitoring required for all community and non-transient, non-community water systems.
h)Unregulated; monitoring required for all community and non-transient, non-community water systems if determined vulnerable
j)Either for a single isomer or for the sum of the isomers.
p)Proposed; No data.
1)Source: 40 CFR, Parts 141, 142, 143. *National Primary & Secondary Drinking Water Regulations* - U.S. EPA, Office of Drinking Water, 4/10/89; unless otherwise noted.
2)Source: *EPA Proposed National Primary & Secondary Drinking Water Regulations 54 FR 22062*, May 22, 1989.
3)Source: *EPA Superfund Public Health Evaluation Manual*, October 1986; unless otherwise noted.
6)Department of Health Services Maximum Contaminant Levels and Action Levels for Contaminants in Drinking Water - October 24, 1990.